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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Memorandum

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SUBJECT: Registered Crops with Little or No Reported Use of Azinphos-methyl and Phosmet

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Summary

The Biological and Economic Analysis Division (BEAD) of the Office of Pesticide Programs (OPP) has reviewed its use and usage data sources for crop sites registered for azinphos-methyl and phosmet use. These sources include commercial proprietary pesticide use data bases (e.g., Doane Marketing Research, Inc.), United States Department of Agriculture (USDA) surveys of pesticide use (e.g., National Agricultural Statistics Service (e.g., NASS 2000. Agricultural Chemical Usage; NASS 1999. Fruit and Nut Summary), USDA reports on specific crops (e.g., USDA

Crop Profiles), and articles from the published scientific literature. These sources are supplemented and validated by telephone or e-mail contact with crop extension agents, grower associations, and other knowledgeable experts in the field.

From this review, the BEAD has identified a number of crops that appear to have little or no reported use of azinphos-methyl or phosmet, even though one or both of these pesticides are currently registered on the crop. BEAD recognizes that available pesticide use data can be somewhat problematic for crops with low acreage (i.e., minor crops), crops that have geographically dispersed acreage, and crops with varieties that require different cultural practices. The actual use of azinphos-methyl and phosmet on these crops may be substantially different from that reflected in the data sources available to BEAD analysts.

There may be special, localized situations on these crops where the need for these pesticides exist. In these cases, the benefits for allowing continued use of azinphos-methyl and/or phosmet would be high. BEAD urges the grower community to provide information documenting these critical uses to the Agency expeditiously so that risk managers may weigh the benefits of maintaining the continued use of these chemical tools against the risks that these pesticides pose to human health and the environment.

Based on the analysis of available azinphos-methyl and phosmet use data, BEAD has identified three groups of crops with little or no current use of these chemicals. Unless additional information is forthcoming, BEAD concludes that there is minimal benefit from the continued registration of these pesticides on these three groups of crops.

These groups are listed below. A brief discussion for each of these crops is in the sections that follow.

Group 1. Both Azinphos-methyl and Phosmet Registered for Use on the Crop, with Little or No Use Reported for Both Active Ingredients

- Alfalfa
- Clover
- Crabapples
- Filberts (Hazelnuts)

Group 2. Azinphos-methyl Only Registered for Use on the Crop, with Little or No Reported Use

- Beans, Succulent
- Birdsfoot trefoil
- Broccoli
- Cabbage, Chinese
- Cauliflower
- Celery
- Citrus (Grapefruit, Kumquat, Lemon, Lime, Orange, Tangerine, Tangelo)
- Cucumbers
- Nursery Stock
- Parsley
- Quince
- Spinach
- Strawberry

Group 3. Phosmet Only Registered for Use on the Crop or Site, with Little or No Reported Use.

- Peas, Green and Dry
- Kiwifruit
- Woodlands

Group 1. Both Azinphos-methyl and Phosmet Registered for Use on Crop, Little or No Use Reported for Both Active Ingredients

Alfalfa and Clover

Production Areas: These forage crops are widely grown. In 1995, approximately 25 million acres of alfalfa and about 37 million acres of clover were grown in the United States (Markle, et al., 1998).

Use / Usage: EPA's Quantitative Usage Analysis for phosmet indicates that the estimated maximum percent crop treated for alfalfa is 0.2 percent. For azinphos-methyl, EPA's Quantitative Use Analysis estimated less than one percent crop treated. Clover was not listed in these analyses.

Impacts on Crop Production: Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on currently available information, BEAD analysts have not identified any critical activities or pests in these crops that would be impacted by extending the restricted entry interval to 10 days. The current pre-harvest interval is 14 days in California, Arizona, and Nevada and is 7 days in all other states.

Crabapples

Production Areas: Crabapple pollinator and ornamental varieties are grown everywhere apples are grown. Crabapple crops are grown in California, New York, and Washington. No production statistics are available. (Markle, et al., 1998).

Use / Usage: Both azinphos-methyl and phosmet are registered for use on crabapples. No use of either active ingredient was identified in data sources available to BEAD. See apples benefit assessment for further discussion.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 14 days for hand harvesting / hand thinning and 2 days for all other activities (3 days for areas receiving less than 25 inches of rainfall per year). Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Because crabapples are often used as pollinators in apple orchards, BEAD suggests that the same restricted entry interval be established for crabapples and apples for each active ingredient. The current pre-harvest interval for crabapples is 7 days for phosmet and 14 days for azinphos-methyl. See apples for further discussion.

Filberts (Hazelnuts)

Production Areas: In 1992, the U.S. produced about 27,148 tons of hazelnuts on slightly over 32,000 acres. Oregon and Washington have about 99 percent of the U.S. acreage (Markel, et al., 1998).

Use / Usage: EPA's Quantitative Usage Analysis indicated minimal use of both chemical on this crop.

Impacts on Crop Production: For phosmet, the current restricted entry interval is 14 days. The phosmet registrant has proposed extending the restricted entry interval to 37 days. The current restricted entry interval for azinphos-methyl is 14 days for hand harvesting / hand thinning and 2 or 3 days for all other activities. Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on the apparent lack of use of both of these chemical on filberts, BEAD believes that there will be little or no impact on the production of this crop by extending the restricted entry intervals for both azinphos-methyl and phosmet.

Group 2. Azinphos-methyl Only Registered for Use on Crop, Little or No Reported Use

Beans, succulent

Production Areas: In 1995, snap bean production for the fresh market was reported at 219,100 tons on 96,300 acres and snap bean production for the processed market was reported at 708,170 tons on 233,040 acres (Markel, et al., 1998).

Use / Usage: From its available data sources, BEAD has not identified significant use of azinphos-methyl on this crop.

Impacts on Crop Production: Based on the apparent lack of use of azinphos-methyl on succulent beans, BEAD believes that there will be little or no impact on the production of this crop by extending the restricted entry intervals.

Birdsfoot trefoil

Production Areas: Trefoils are widely grown for forage and hay from the Ohio and Potomac Rivers north into Canada and west to the edge of the Great Plains. It is also grown in western Oregon. In 1992, 7,375 acres produced about 260 tons of seed. Top seed producing states are Michigan, Wisconsin, and Minnesota (Markle, et al., 1998).

Use / Usage: BEAD has not identified any use of azinphos-methyl on this crop in its data sources.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 4 days (5 days for areas receiving less than 25 inches of rainfall per year). Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on the apparent lack of use of azinphos-methyl on birdsfoot trefoil, BEAD believes that there will be little or no impact on the production of this crop by extending the restricted entry intervals.

Broccoli

Production Areas: In 1995, broccoli was planted on 104,100 acres with fresh market production at 544,400 tons and processing at 64,500 tons. Top producing states are California, Arizona, Texas, and Oregon. California ranks first in both the fresh and processing market. For the fresh market, California and Arizona produced about 99 percent of the crop. For the processing market, California produces about 74 percent of the crop (Markel et al., 1998).

Use / Usage: BEAD has not identified any significant use of azinphos-methyl on this crop from its data sources.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 4 or 5 days, depending on rainfall, for all worker activities. Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on the apparent lack of use of azinphos-methyl on broccoli, BEAD believes that there will be little or no impact on the production of this crop by extending the restricted entry intervals. The current pre-harvest interval is 15 days.

Cabbage, Chinese

Production Areas: In 1992, about 8,800 acres of Chinese cabbage were produced in the U.S. Top producing states are California, Florida, Hawaii, and Michigan (Markel et al., 1998).

Use / Usage: EPA's Quantitative Usage Analysis indicated minimal use of azinphos-methyl on this crop.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 4 days (5 days for areas with less than 25 inches of rain per year). Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on the apparent lack of use of azinphos-methyl on Chinese cabbage, BEAD believes that there will be little or no impact on the production of this crop by extending the restricted entry intervals.

Cauliflower

Production Areas: In 1995, 51,500 acres produced 282,750 tons of fresh market and 43,510 tons of processed cauliflower. The top states are California, Arizona, Oregon, New York, Michigan and Texas. California and Arizona account for 90 percent of the production of this crop.

Use / Usage: BEAD's QUA for azinphos-methyl reports about 1 percent of the crop is treated. The California DPR use census reports that 2 percent of the cauliflower crop was treated in 1998 and 0.29 percent was treated in 1999.

The Crop Profile for California Cauliflower recommends azinphos-methyl for the control of the cabbage maggot, *Delia radicum,* and the seed corn maggot, *Delia platura*. The cabbage maggot is primarily a problem for coastal cauliflower growers, particularly in the cooler wet periods of the year. The cabbage root maggot fly is dark gray and about 12 mm (0.47 in) in length. The white legless larvae are 8mm (0.31 in) at maturity and are found in dense colonies developing on the feeder and taproot of cole crops. Several hundred larvae can be found on one plant. Larvae feed for 3 to 5 weeks, and then pupate in the soil or on the roots of a host plant. After 2 to 3 weeks pupation the adult fly emerges. Two to 3 or more generations may occur annually.

Cabbage maggots can seriously damage or destroy root systems of cole crops. Subsequent results include plant stunting, yellowing and wilting during the hot period of the day. The tunnels formed by cabbage maggot feeding provide an entry point for the pathogens causing blackleg and bacterial soft rot. Young seedlings are most susceptible to permanent damage.

Seed corn maggots attack the seeds and seedlings of many crops, including cauliflower. This pest has a wide host range but does particularly well in the higher humidity and cooler climate of coastal growing areas, where it is also in close proximity to alternate host crops. Eggs are laid singly or in small clusters in the soil near the base of the plant. Newly hatched white maggots feed on plant roots, completing this cycle in 2-3 weeks. The larvae then pupate in the soil with the adult fly emerging in 7 days. Numerous generations can occur yearly in California. This insect is found mostly in the cool spring conditions in soils with high organic

content. Unlike the cabbage maggot, the seed corn maggot does not attack plants after the seedling stage; therefore, once the stand is established these pests are not an economic problem.

Azinphos-methyl is normally tank-mixed with chlorpyrifos for cabbage maggot control after periods of rainfall. Azinphos-methyl is also labeled for the diamondback moth (*Plutella xylostella*), which suggests that some of the San Joaquin Valley applications may have been made in an attempt to control the intense outbreak of the diamondback moth. Usage of azinphos-methyl may have decreased as a result of the registration of spinosad (Success) in 1997.

Three other chemicals are often used for the control of the cabbage maggot in cauliflower – chlorpyrifos, diazinon, and fonofos. Chlorpyrifos is the most efficacious insecticide for the control of cabbage maggot in cauliflower. It is also extensively used for aphid control in coastal areas and worm management in the desert region. Diazinon is registered for use against cabbage maggot, but it is not as efficacious as chlorpyrifos. Fonofos can be used at preplant until December 31, 2001, at which time registration will expire and the manufacture will buy back remaining stocks of the product. There are no known effective biological controls for the cabbage maggot.

Maggot populations are extremely erratic and unpredictable in nature; therefore, cultural control programs are difficult. Since maggots require crop residue and high organic matter in soil to persist between crops, fallowing fields for even short periods can reduce maggot incidence significantly, particularly if the soil is allowed to dry between successive crops. Deep plowing and cultivation to bury organic matter deep underground may also reduce maggot pressure. Any other method of cultivation or crop management directed at avoidance of organic matter in the seed row, can reduce maggot incidence and damage to the young crop. Discing the previous crop a minimum of two weeks prior to planting, as well as using a drag chain following direct seeding, to reduce moisture from the seed row where the female lays its eggs, may also reduce maggot populations.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 4 days (5 days for areas with less than 25 inches of rain per year). The pre-harvest interval for cauliflower is 15 days. Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on the low use of azinphos-methyl and availability of chemical alternatives, BEAD believes that little or no economic impact would result from extending the restricted entry intervals.

Celery

Production Areas: In 1992, 35,580 acres of celery were grown in California, Florida, Michigan, Texas, New York, and Ohio (Markle, et al., 1998).

Use / Usage: The primary insect pest on celery is the aster leafhopper (*Macrosteles fascifrons*). This insect has piercing-sucking mouthparts that enter the vascular tissue of its host plants and suck out the plant sap. If the populations are not very high, this activity does not usually seriously damage celery; however, the insects do transmit a phytoplasma that causes aster yellows. This disease dwarfs the celery, and causes abnormal shape and poor flavor. Aster yellows pre-disposes the plants to other diseases.

In Michigan, aster leafhoppers move into celery fields in late May or early June from their overwintering sites. The disease organism takes about 3 weeks inside the leafhopper before it can be transmitted to plants. It takes about 2 weeks from infection before the disease causes symptoms in the celery.

The secondary insect pest is the carrot weevil (*Listronotus oregonensis*). The adult insects leave circular feeding holes on the underside of the leaf petioles, but the larvae tunnel on the outer surface of the celery, making the celery unacceptable for either fresh or processing markets. Weevils overwinter as adults in the soil of fields, margins, and ditch banks. They emerge in mid-April to late May and begin feeding and laying eggs on the celery. Within a week larvae bore into the roots, where they spend 2-4 weeks. They pupate in the surrounding soil and the first generation will emerge mid-June and begin laying eggs in 2 weeks. A female may continue to lay eggs until late August, therefore, all stages of the insect can be present at any time.

Three other chemicals are used to control the aster leafhopper and carrot weevil on celery – permethrin, oxamyl, and acephate. The timing of the applications is critical for the effective use of permethrin and oxamyl. These two chemicals are most effective against adults prior to egg-laying and against larvae prior to their burrowing into the stalk. Because acephate is a systemic insecticide the timing of its application is less critical.

Non-chemical methods of control for the aster leafhopper include the removal of diseased plants and the control of weeds that serve as alternative hosts. Non-chemical control methods for control of the carrot weevil include crop rotation and late planting. BEAD has not identified any information concerning biological controls of these pests.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 4 days (5 days for areas with less than 25 inches of rain per year). Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. California reports very low use of azinphos-methyl and BEAD has not identified azinphos-methyl use on celery in other states. Based on this apparent low usage, BEAD believes that extending the restricted entry intervals would not have a significant economic impact.

Citrus (Grapefruit, Kumquat, Lemon, Lime, Orange, Tangerine, Tangelo)

Production Areas: In 1995-1996, the total US citrus production was reported to be about 16 million tons from 1.1 million bearing acres. Over 70 percent of the production was processed. Major producing states are Florida, Texas, Arizona and California (Markle, et al., 1998).

Use / Usage: BEAD investigated the use of azinphos-methyl in citrus at the state level, with the following results:

Arizona. – Azinphos-methyl has not been used in Arizona on oranges or grapefruits for several years. One source of data gathered in 1995 shows that azinphos-methyl was used on 60% of lemons in Arizona. USDA's NASS report shows no use of the pesticide since 1999. An IPM specialist in Arizona reported that azinphos-methyl was used on lemons in certain areas primarily for control of the California Red Scale. Other pests of lesser importance included Cottony Cushion Scale, and citrus thrips. As of about 4 years ago, only a small amount of azinphos-methyl was in use and only for scale control. Since that time, growers have moved to Insect Growth Regulators (IGRs) and other options to control these pests with good success.

Lemon growers used azinphos-methyl about 5-6 years ago during an unusual breakout of Cottony Cushion Scale. There are occasional limited re-occurrences of this pest. Other pesticide products are now used for scale control. Lemon growers have stated that azinphos-methyl would be of little use if the REIs were extended. Hand harvesting begins in September. Scale isn't easily identified until after bud-set in June/July, so if a scale problem were to develop, azinphos-methyl could not be used if a long REI prevented hand-harvesting the crop in September. An extended REI for irrigation/scouting is also problematic, because irrigation (flood) is a frequent activity, and scouting is a frequent and integral part of their grove management

practices. An extended REI for propping might be acceptable because of when the activity is conducted. An extended REI for thinning activities would have no impact because lemon trees are not thinned in Arizona.

A representative of a registrant for azinphos-methyl products could not recall the last time azinphos-methyl was used in citrus in Arizona. According to the registrant representative, growers are now using IGRs (such as Esteem), or even methidathion or chlorpyrifos to control scale.

Texas. – Azinphos-methyl has not been used in Texas on oranges or grapefruits for several years, although the USDA's NASS report for 1999 indicates a small, unquantified use. According to a Texas IPM Extension Agent for citrus and vegetables, azinphos-methyl was used more frequently about 20 years ago, but it hasn't been used for 10-12 years. Loss of this pesticide would have no negative impact on citrus production in Texas.

Puerto Rico. – The Citrus Commodity book indicates that 10% of oranges grown in Puerto Rico are treated with azinphos-methyl for "sucking insects, defoliators". Usage data are not collected by USDA/NASS for Puerto Rico. According to a USDA Extension Agent (USDA Agricultural Extension, University of Puerto Rico), AZM is used on approximately 8 - 10% of oranges grown in Puerto Rico. AZM is typically used between March and October to control insects such as whitefly, aphids, and scale. Other pesticides are now used to control these pests, including malathion, carbaryl, and oil. Extending the REIs for AZM would significantly limit scouting and the grove maintenance (such as pruning) work that must be performed by workers on a regular basis. REIs could be no longer than 45 - 60 days, depending on the activity, if AZM is to remain a viable tool for orange production. Nevertheless, if the use of AZM on oranges were discontinued, there would be no effect on the yield or quality of the orange crop in Puerto Rico because of the availability and use of effective pesticide alternatives.

California. – Azinphos-methyl has not been used in California on lemons, oranges, or grapefruits for several years (NAPIAP, 1999; USDA/NASS 1999).

Florida. – Azinphos-methyl has not been used in Florida on oranges, tangelos, or grapefruits for several years (NAPIAP, 1999; USDA/NASS 1999).

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 30 days for hand harvesting and hand thinning; 2 days for all other activities (3 days for areas receiving less than 25 inches of precipitation per year). Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. BEAD believes that extending the REIs would essentially prohibit the use of azinphos-methyl on citrus, but this is not a significant issue because the pesticide is no longer used. This conclusion is based on data sources available to the Agency, and phone conversations with individuals knowledgeable about citrus in USDA's Cooperative Extension Service, a pesticide registrant, and a citrus grower.

Azinphos-methyl was used in citrus crops many years ago for control of certain defoliating and sucking insects (such as scale), but citrus growers now use other pesticides for these pests. The last major use of azinphos-methyl was for control of scale insects in Arizona several years ago, but this was an unusual pest outbreak and the pesticide provided limited pest control. Since that time, citrus growers in Arizona and elsewhere have successfully moved to insect growth regulators and other options for the control of scale insects.

Cucumbers

Production Areas: In 1995, about 500,000 tons of cucumbers were produced for the fresh market and about 600,000 tons were produced for the processed market. The top states for fresh market cucumbers were Florida, Georgia, North Carolina, Virginia, Michigan, California, New York, South Carolina, Texas and New Jersey. The top states for processing cucumbers were Michigan, North Carolina, Texas, South Carolina, Wisconsin, Florida, California, Ohio, Indiana, and Colorado (Markle, et al., 1998).

Use / Usage: EPA's Quantitative Usage Analysis indicated minimal use of azinphos-methyl on cucumbers.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 4 days (5 days in areas receiving less than 25 inches of precipitation per year). The preharvest interval is 4 days. Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on the apparent lack of use of azinphos-methyl on cucumbers, BEAD believes that there will be little or no impact on the production of this crop by extending the restricted entry intervals.

Nursery Stock

This registered site represents an extremely diverse industry. BEAD does not have sufficient information to qualitatively estimate azinphos-methyl use.

Parsley

Production Areas: In 1994, parsley was grown on approximately 5,100 acres, with about half the acres located in California. The majority of the California crop is dehydrated into spice.

Use / Usage: EPA's Quantitative Usage Analysis indicated minimal use of azinphos-methyl on parsley.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 4 days (5 days in areas receiving less than 25 inches of rain per year). Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on the apparent lack of use of azinphos-methyl on parsley, BEAD believes that there will be little or no impact on the production of this crop by extending the restricted entry intervals.

Quince

Production Areas: California is reported to be a key production area for quince with about 200 acres in production (Markle, et al., 1998). BEAD does not have additional information available concerning this crop.

Use / Usage: EPA's Quantitative Usage Analysis indicated minimal use of azinphos-methyl on quince.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 14 days for hand harvesting / hand thinning and 2 days for all other activities (3 days for areas receiving less than 25 inches of precipitation per year). The preharvest interval is 14 days for application rates less than 1 lb ai per acre and 21 days for application rates greater than 1 lb ai/A. Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on the

apparent lack of use of azinphos-methyl on quince, BEAD believes that there will be little or no impact on the production of this crop by extending the restricted entry intervals.

Spinach

Production Areas: In 1995, 97,100 tons of spinach were grown on 17,200 acres for the fresh market and 149,680 tons of spinach were grown on 22,220 acres for the processed market. Top producing states for processed spinach are Texas, Arkansas, California, Oklahoma, Tennessee, and Wisconsin. Top producing states for fresh spinach are California, Colorado, Texas, New Jersey, Maryland, and Virginia. In 1993, Washington produced 75 percent of the U.S. spinach seed production on about 3,000 to 4,000 acres (Markle, et al., 1998).

Use / Usage: EPA's Quantitative Usage Analysis indicated less than 1 % of the spinach crop was treated with azinphos-methyl.

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 4 days (5 days in areas receiving less than 25 inches of rain per year). Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on the minimal use of azinphos-methyl on spinach, BEAD believes that there will be little or no impact on the production of this crop by extending the restricted entry intervals.

Strawberry

Crop: Strawberries *(Fragaria* spp.) are a perennial, stoloniferous herb grown as either an annual or perennial crop depending on the intensity of production. There are three species of strawberries cultivated commercially for their fruit: *Fragaria* X *ananassa* Duch. (the major cultivated type), *F. moschata* Duch., and *F. vesca* L. There are short day (spring fruiting), long day, and day-neutral flowering types. Most cultivars have perfect flowers and therefore do not need cross pollination for fruit set. However, bee activity is beneficial in transferring pollen to stigmas in an individual flower. The true, botanical fruit of the strawberry is an achene, which is a small, dry, indehiscent fruit with seed loosely adherent to the ovary wall; the sunflower is the best example. The edible portion is swollen receptacle tissue; hence, the fruit can be termed aggregate since many pistils of the same flower form the fruit, but most often is termed accessory since non-ovarian tissues make up the edible portion.

Production: In 2000, United States strawberries were grown on 49,100 acres. In 1999, California grew 27,600 acres; Florida, Oregon, and Washington grew 6,300, 4,100 and 1,600 acres, respectively (USDA Ag. Stats., 2000). These four states account for 80 percent of the US acreage with an additional ten states accounting for the last 20 percent of the acreage. The acreage devoted to strawberries has been fairly stable over the last four years. The yields per acre range from a high of 550,000 lbs per acre in California to 350,000, 100,000, and 86,000 lbs per acre in Florida, Oregon, and Washington, respectively. The total value of strawberries in the United States was approximately one billion dollars. The value of strawberries in California was $767 million; Florida, Oregon, and Washington were valued at $167 million, $17 million and $6 million, respectively.

Cultural Practices: Fumigation to control disease and nematodes is commonly done in California and Florida but less so in Oregon, Washington, or Michigan. Plastic mulch is commonly used to reduce disease of the berries and weed competition. The crop is typically established from runner plants transplanted into the field. Fruit can develop in as little as 4 to 6 weeks after transplanting under the various cropping systems. After the plants are transplanted, field operations typically include cultivation, irrigation, hand weeding, pest scouting, and harvesting. Under perennial systems, the vines are pruned or mowed back in the fall. Pesticides are typically applied with ground equipment.

Use / Usage: Azinphos-methyl use on strawberries in the United States in 1998 is given in Table 1. The major strawberry producing states of California, Florida, Oregon, and Washington reported no azinphos-methyl usage in the same 1998 survey (Agricultural Chemical Usage 1998 Vegetable Summary). When experts were contacted in these states they indicated that there were no situations where azinphos-methyl was considered a key component of their pest management strategies.

Table 1. Azinphos-methyl Use on Strawberries in the United States in 1998.

Area Applied (%)	Average Number of Applications	Average Application Rate (lbs ai/acre)	Average Rate per Crop Year (lbs ai/acre)	Total Applied (1000 lbs)
5	1.2	0.62	0.75	1.8

Impacts on Crop Production: The current restricted entry interval for azinphos-methyl is 4 days (5 days in areas receiving less than 25 inches of rainfall per year. The pre-harvest interval is 5 days. Please refer to the occupational and residential human health risk assessment on the Agency's website (http://www.epa.gov/pesticides/op) for information concerning the worker risks associated with the restricted entry intervals for this chemical. Based on personal communication with crop experts, BEAD has not been able to identify any state that uses azinphos-methyl as a key component of their pest management strategy. These crop experts report that there is very little use of this insecticide.

Increasing the REI beyond 7 days would eliminate any use of azinphos-methyl on strawberries because of the scouting, weeding, and pruning operations that must occur for proper management of the crop. Growers would likely switch to alternative insecticides. There would be little change in yield or quality of the crop.

Group 3. Phosmet Only Registered for Use on Crop, Little or No Reported Use.

Peas, Dry & Green

Production: Total U.S. green pea production averages 496,000 tons per year, and is valued at $129 million (see Table 2). Production includes peas for canning and freezing. Five states (Minnesota, New York, Oregon, Washington, and Wisconsin) account for more than 80% of U.S. production of green peas.

Table 1. Green Peas (Processed) Production and Value of Production in the U.S. and Major States [1, 2]

Region	Harvested Acreage (Acres)	Production (Tons)	Percent of US Production	Value of Production ($1000)
US	274,440	495,820	–	$129,313
Minnesota	83,900	131,540	27%	$43,731
New York	15,600	32,270	7%	$8,328
Oregon	33,800	56,110	11%	$12,246
Washington	50,700	104,230	21%	$23,613
Wisconsin	46,850	92,140	19%	$20,415
Other States [3]	43,590	79,530	16%	$20,980

1. Source: USDA/NASS 2000 Vegetables Summary
2. Processed green peas include those for canning and freezing.
3. Other states include: for 1999 - California, Delaware, Idaho, Illinois, Iowa, Maine, Maryland, Michigan, New Jersey, Pennsylvania, Tennessee; and for 2000 - California, Delaware, Idaho, Illinois, Maine, Maryland, New Jersey, Tennessee.

Total U.S. dry edible pea production averages 414 million pounds per year, and is valued at $22 million (see Table 2). More than 95% of total U.S. production occurs in Idaho, Montana, North Dakota, and Washington.

Table 2. Dry Edible Pea Production and the Value of Production in the U.S. [1]

Region	Harvested Acreage (Acres)	Production (1000 cwt)	Percent of US Production	Value of Production ($1000)
US	216,000	4,136	–	$21,979
Idaho	39,000	732	18%	$4,408
Montana	27,000	320	8%	$1,766
North Dakota	60,000	1,224	30%	$5,439
Washington	88,000	1,794	43%	$9,993
Other States [2]	4,000	68	2%	$374

1. Source: USDA/NASS 2000 crop production summary and 2000 crop values summary.
2. Other states include: for 1999 - Nevada and Oregon; for 2000 - Oregon.

Phosmet Usage on Green and Dry Peas: Table 3 lists the usage of phosmet on U.S. processed green peas for the U.S. and by state. On average, an estimated 1% of the US green pea acreage is treated with phosmet. Phosmet is applied to green pea acreage in only three states, and only Idaho has more than 2% of its green pea acreage treated with phosmet. On average, nearly 40% of the Idaho green pea acreage is treated with phosmet - a total of approximately 1,700 acres.

Table 3. Usage of Phosmet on Green Peas (Processed) in the U.S. [1, 2, 3]

Region/State	Percent of Crop Treated	Base Acres Treated (1000 acres) [4]	Total Pounds Applied (1000 lbs)
U.S.	1%	3.3	2.5
Idaho	39%	1.7	1.2
Oregon	2%	0.7	0.5
Washington	2%	1.0	0.8

1. Source: USDA/NASS Vegetable Summary, 1998 and EPA proprietary data.
2. Processed peas include those for canning and freezing.
3. Percent crop treated values are estimated by BEAD. Crop experts that BEAD contacted indicate that 50 to 75% of green and dry peas may be treated with phosmet in a given year depending on the level of weevil infestations. This pressure may be increasing.
4. Base acres treated are calculated using percent of crop treated estimates and planted acreage estimates from USDA/NASS - U.S.=291,340 acres, Idaho=4,295 acres, Oregon=33,800, Washington=52,300.

Table 4 lists the usage of phosmet on the U.S. dry edible pea acreage for the U.S. and by state. On average, an estimated 2% of the U.S. dry pea acreage is treated with phosmet. Idaho and Washington are the only states estimated to have used phosmet on dry peas, and neither state treats more than 5% of their dry pea acreage.

Table 4. Usage of Phosmet on Dry Edible Peas in the U.S. [1]

Region/State	Percent of Crop Treated	Base Acres Treated (1000 acres) [2]	Total Pounds Applied (1000 lbs)
U.S.	2%	5.5	4.1
Idaho	5%	2.0	1.7
Washington	4%	3.5	2.4

1. Source: USDA/NASS Fruit and Nut Chemical Use, 1998 and EPA proprietary data.
2. Base acres treated calculated using percent of crop treated estimates and planted acreage estimates from USDA/NASS - U.S.=228,000 acres, Idaho=40,000 acres, Washington=88,000.

Target Pests: The pea weevil, *Bruchus pisorum,* is considered a serious pest of peas, and is found throughout the entire pea production region. Pea weevils cause significant damage and economic loss nearly every year. Adult weevils over-winter in fencerows, in timbered areas adjacent to fields and on roadside vegetation. Larvae are the most damaging, and burrow directly through the pod and consume the pea seed. The economic threshold for initiating pea weevil control is reached when more than 2 weevils per 25 sweeps are found. Insecticides are applied to prevent the females from laying eggs. Once eggs are laid on the pea pods, all treatments are ineffective.

Another serious pest is the pea leaf weevil, *Sitona lineatus.* It is the adult that causes economic loss in all dry pea production areas every year and in green pea production most years. Most of the damage occurs in spring on peas in the seedling stage. Early adults feeding on seedlings cause scalloped leaf edges and damaged terminal buds. Severe foraging may cause heavy leaf damage, destruction of the terminal buds, and ultimate destruction of the plant.

Phosmet is applied to seedlings early in the season if pea leaf weevils are present. If pea weevils reach the economic threshold, then phosmet is applied. This occurs generally mid-summer when the pea pods are developing. Chemical alternatives to phosmet include esfenvalerate, carbaryl, and malathion. Currently there are no natural predators specific to the pea or pea leaf weevils. Generalist predators are usually not present in high enough numbers to influence weevil populations. BEAD has not identified any cultural control for these pests.

Impacts on Crop Production: Peas are mechanically harvested. The REI of 7 days for mechanical harvesting should not significantly impact the industry since workers would not need to enter the field for the week prior to harvest. Since there is little to no hand harvesting in peas, an extended REI for hand harvesting does not appear to be significant. Please refer to the Agency's human health risk assessment for phosmet at http://www.epa.gov/pesticides/op/phosmet.htm; the Occupational and Residential Exposure Aspects for information on risk reduction associated with this extension. The vast majority of pea growers will not be impacted by this mitigation.

Kiwifruit

Crop: Kiwifruit is the fruit of a perennial vine. The fruit is egg sized and covered with brown skin and fuzz. When sliced, the fruit yields an attractive emerald green flesh with rows of small, dark, edible seeds, and a light

cream colored center. Its flavor is similar to a blend between strawberry and pineapple. Grown commercially in California, kiwifruit plants are woody twining vines that are trellised on a single wire, 3-5 wires, or T-bar for cultivation. They are grown in sunny locations protected from strong winds. The plants need large volumes of water during the growing season. Plants bear either male or female flowers, thus plants of both sexes are needed to produce fruit. There are a few growers who practice blossom thinning.

Kiwifruit plants are routinely pruned both in the summer and winter. Summer pruning helps open the dense canopy to allow for air movement and filtered sunlight. This reduces the incidence of botrytis fruit rot and fruit softening. Winter pruning trains the plant on the trellis system. Kiwifruit are hand-harvested from October 1 through May 31.

Production: More than 95% of total U.S. kiwifruit production occurs in California. Most of this production is organically grown. California production averages 28,000 tons per year from 5,300 bearing acres and is valued at $20 million. Production of kiwifruit also occurs in Alabama, Georgia, Oregon, South Carolina, Tennessee, Virginia, and Washington. Among these states, only Oregon and South Carolina account for as much as 1 percent of U.S. kiwifruit acreage grown (USDA/NASS noncitrus fruits and nuts preliminary summary, 2000; USDA California kiwifruit crop profile, 2000).

Table 6 lists the usage of phosmet on kiwifruit in California. On average, phosmet is applied to one percent of the kiwifruit acreage in California.

Table 6. Usage of Phosmet on CA Kiwifruit [1]

Percent of Crop Treated	Base Acres Treated [2]	Total Pounds Applied	Average Number of Applications (#/year)	Median Application Rate (lbs/acre)
1%	53	52	1.00	1.70

1. Source: USDA/NASS Fruit and Nut Chemical Use, 1997 and 1999 and CDPR Pesticide Usage Database for 1998 and 1999.
2. Base acres treated are calculated using percent of crop treated estimates and bearing acreage.
3. US EPA Quantitative Usage Analysis (QUA) for phosmet, 4/2001, estimates an average of 8% crop treated and 1,000 pounds applied in the U.S., and is based on up to ten years of data and multiple data sources.

Target Pests

The primary insect pests that are controlled by phosmet are the leafrolling caterpillar complex, most common and damaging is the omnivorous leafroller, *Platynota stultana*. Other insect pests include armored scale insects and boxelder bugs.

The omnivorous leafroller, *Platynota stultana*, is the most destructive insect pest on kiwifruit in CA. Although the omnivorous leafroller and the other leafrollers typically feed on leaf tissue that they have rolled up, they will also feed directly on the fruit, scarring the surface and tunneling into mature fruit. Depending on weather conditions there are 4-6 generations a year.

Armored scale insects (*Hemiberlesia rapax*, *H. lataniae*, *Aspidiotus nerii*) attack the bark and fruit of kiwi. Heavy infestations affect the vigor of the plant. If scales occur on the fruit, it will be offgrade. Pesticide applications for the scale insects normally occur after pruning and tying is complete.

The boxelder bug, *Leptocoris trivittatus,* is a sporadic pest in the coastal areas of California. Although this insect pest occurs relatively early in the season, its feeding causes bud and fruit drop and fruit malformation. Therefore, this insect must be controlled during the blossom stage. In most areas, workers will not be in the

field at this time, but there are a few growers who practice blossom thinning. It is this group that would be most affected by extending the restricted entry intervals.

Alternative Pest Control Methods: Currently, the majority of growers use *Bacillus thuringiensis* and cryolite as the preferred treatments for the leafroller complex. For scale insects most growers use oil sprays alone or, if populations are high, oil in combination with methidathion. There are no chemical alternatives to phosmet for boxelder bugs.

Based on California Department of Pesticide Regulation pesticide use data (1998-1999), an average of 6% of the California kiwifruit acreage is treated with *Bacillus thuringiensis*, 7% of the acreage is treated with cryolite, 14% of the acreage is treated with petroleum oil, and 14% is treated with methidathion.

There are no biological control strategies for either the leafroller complex or boxelder bugs. Scales can be managed by natural enemies, such as lacewings, predaceous mites, and parasitic wasps. No cultural controls were identified.

Impacts on Crop Production: The majority of kiwifruit in California is organically grown and therefore would not be affected by mitigation to extend the current REI for phosmet of 24 hours to 28 days. The only growers that would suffer from the extended REIs would be those that have boxelder bugs and practice blossom-thinning, roughly about 50 acres. If kiwifruit is treated for boxelder bugs, then an REI of 28 days could interfere with blossom thinning. Applications to control omnivorous leafroller, the other leafrollers, and scales do not usually interfere with worker activities. A few growers prune in the summer. This practice, although not standard, could also be affected by an extended REI of 28 days. BEAD concludes negligible impact from extending the REI of phosmet in kiwi to 28 days. Please refer to the Agency's human health risk assessment for phosmet at http://www.epa.gov/pesticides/op/phosmet.htm; the Occupational and Residential Exposure Aspects, for information on risk reduction achieved by this extension.

Woodlands

BEAD has no information concerning the use of phosmet in woodlands.

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